



SAMSUNG DISPLAY



Product Information

- () **Product Information**
(√) **Approval Specification**

Any modification of Spec is not allowed without SDC's permission

CUSTOMER	G/A Customers
DATE OF ISSUE	09/28/2012

MODEL NO.	LTi700HA02
EXTENSION CODE	-0

Customer Approval & Feedback	

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REVISION HISTORY

Date.	Rev.No.	Page	Revision Description
09/28/2012	000	all	Fist issued

For GA Only

GENERAL DESCRIPTION

DESCRIPTION

LTI700HA02-0 is a color active matrix liquid crystal display (LCD) that uses amorphous silicon TFT (Thin Film Transistor) as switching components. This model is composed of a TFT LCD panel, a driver circuit, and a back-light unit. This 70.0" model has a resolution of 1920 x 1080 pixels (16:9) can display up to 16.7 Million colors with the wide viewing angle of 89° or higher in all directions. This panel is intended to support applications to provide an excellent performance for Flat Panel Display such as Home-alone Multimedia TFT-LCD TV, Display terminals for AV application products, and Digital Information Display (DID).

FEATURES

High contrast ratio & aperture ratio with the wide color gamut
RoHS compliance (Pb-free)
High Tni Liquid Crystal
SPVA (Super Patterned Vertical Align) mode
Wide viewing angle ($\pm 178^\circ$)
High speed response (with DCC circuit)
Wide UXGA (1920 x 1080 pixels, 16:9)
Edge LED (Light Emitted Diode) BLU
DE (Data enable) mode
The interface (2pixel/clock) of LVDS serial interface

APPLICATIONS

Digital Information Display (DID)

GENERAL INFORMATION

Item	Specification	Unit	Note
Display area	1549.44 (H) x 871.56 (V)	mm	
Driver Element	a-Si TFT active matrix		
Display colors	16.7M (8bit)		
Number of pixel	1920 X 1080	Pixel	
Pixel Arrangement	RGB vertical stripe		
Pixel pitch	0.807 (H) x 0.807 (V) (Typ)		
Display Mode	Normally Black		
Surface treatment	Haze 2.3%(Typ) / 2H(min)		Anti-Glare
Luminance of White	400(Typ)	cd/m ²	

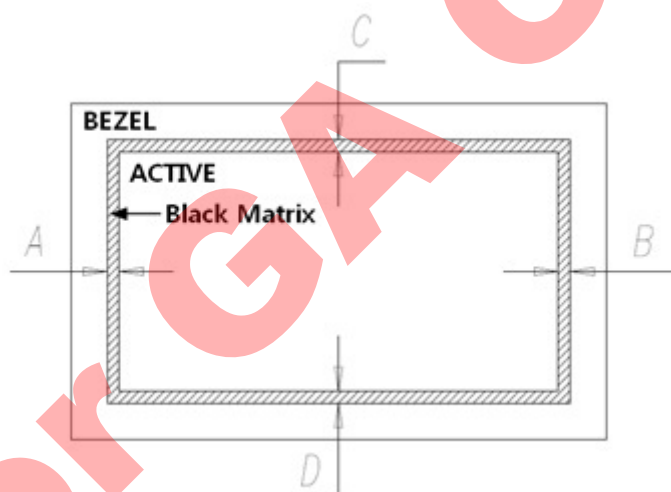
MECHANICAL INFORMATION

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	1598.0	1600.0	1602.0	mm	
	Vertical(V)	920.0	922.0	924.0	mm	
	Depth(D)	10.7	11.7	12.7	mm	Min depth (2)
Bezel Open	Horizontal(H)	1558.0	1560.0	1562.0	mm	
	Vertical(V)	880.0	882.0	884.0	mm	
Black Matrix Shift	Horizontal(H)	-	-	3.0	mm	(1)
	Vertical(V)	-	-	3.0		
Weight			31,000	33,000	g	

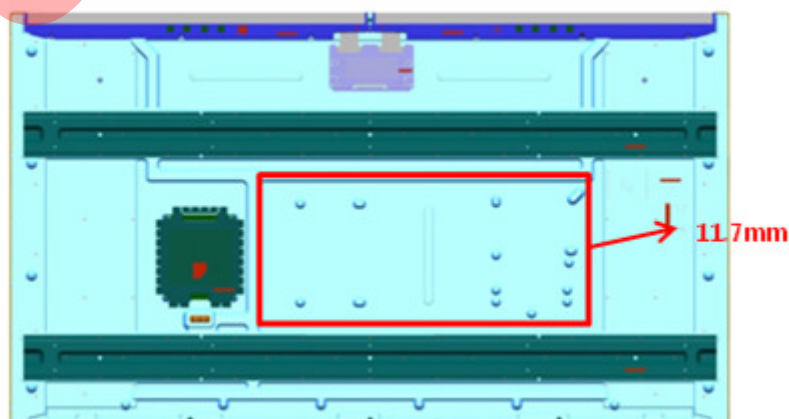
NOTE (1) Measure the figure for **Black Matrix shift** to be recorded on the spec. with referring to the drawings.

| A - B | ≤ Horizontal Spec

| C - D | ≤ Vertical Spec



Note (2) Measure point of Depth



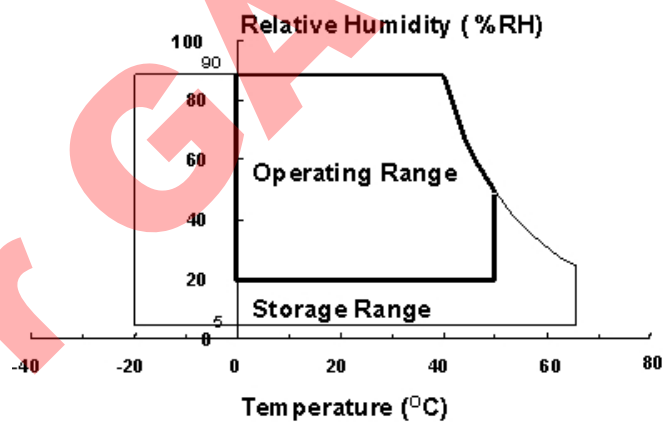
1. ABSOLUTE MAXIMUM RATINGS

1.1 ENVIRONMENTAL ABSOLUTE RATINGS

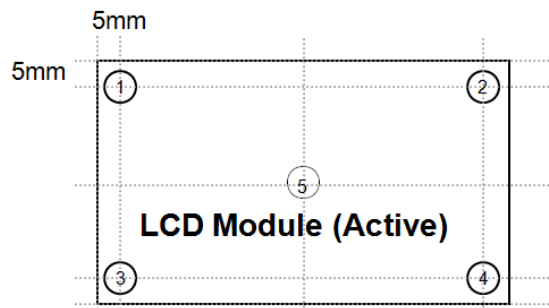
Item		Symbol	Min.	Max.	Unit	Note
Storage temperature		T _{STG}	-20	65	°C	(1)
Operation Temperature		T _{OPR}	0	50	°C	(1)
Humidity for storage		H _{STG}	5	90	%RH	(1)
Operating humidity		H _{OPR}	20	90	%RG	
Glass Surface temperature (Operation)	Center	T _{SUR}	0	50	°C	(2)
	T.Uniformity	△T	-	10	°C	
Shock (non-operating)		Snop(X,Y, Z)	-	-	G	(3)
Vibration (non-operating)		V _{nop}	-	-	G	(3)

Note (1) Temperature and relative humidity range are shown in the figure below.

- 90 % RH Max. (Ta ≤ 39 °C)
- Relative Humidity is 90% or less. (Ta > 39 °C)
- No condensation



Note (2) Definition of test point



Note (3) Module vibration and shock tests are not guaranteed due to limitation of equipment for this model.

1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V _{DD}	10.8	13.2	V	(1),(2)
Dimming Control	V _{dim}	-	5.25	V	(1)

Note (1) Within Ta (25 ± 2 °C)

(2) The permanent damage or defect to the device may occur if the panel is operated at the figure set, which exceeds a limit of maximum value state d in the former spec. The functional operation should be limited to the conditions described above under normal operating conditions.

(2) BACKLIGHT UNIT

Item	Symbol	Min.	Max.	Unit	Note
Input Supply Voltage / Converter	V _{CC}	-	26.4	V	

1.3 The Others Absolute Ratings

STATIC ELECTRICITY PRESSURE RSISTANCE

Item	Symbol	Min.
CONTACT DISCHARGE	150pF, 330Ω, ± 8kV, 200points, 1 time/point	Operating
AIR DISCHARGE	150pF, 330Ω, ± 15kV, 200points, 1 time/point	Operating

2. APPLICATION INFORMATION FOR DID (Digital Information Display)

A DID's screen may display the sudden image such as an image retention.

To extend the lifetime and optimize a function of module, the below-mentioned operating conditions are required.

2.1 Normal operating condition

- a. Temperature: $20 \pm 15^{\circ}\text{C}$
- b. Humidity: $55 \pm 20\%$
- c. Display pattern: Moving image or image, which switches regularly.
Note) The sudden image on the screen can be displayed after the static image is shown in the long-term.

2.2 The operating conditions when the module is operated under the abnormal condition.

- a. Ambient condition
-It is recommended to set the DID up in the well-ventilated place.
- b. The function of power off and screen saver
-The function of periodical power-off or a screen saver is needed when the static image is displayed in the long-term.

2.3 Operating conditions to prevent the sudden display resulted from displaying the static image in the long-term.

- a. The proper operating time: Under 20 hours a day.
- b. The moving image shall be inserted between the static displays periodically.
-The refresh time for liquid crystal is needed.
- c. The periodic changing of background color and character's color(image)
-Use the different color for background and character (image) respectively.
-Change colors periodically.
- d. Avoid combining the color for background with the color for character, which has a largely different luminance.

Note (1) Abnormal condition means all operating condition except normal operating condition.

Note (2) The moving image or black pattern is strongly recommended as a screen saver.

2.4 Only the lifetime of DID stated in this spec is guaranteed if the DID is used under the proper operating conditions.

3. OPTICAL CHARACTERISTICS

The optical characteristics should be measured in a dark room or equivalent.

Measuring equipment : TOPCON RD-80S, SR-3, ELDIM EZ-Contrast

$T_a = 25 \pm 2 \text{ }^{\circ}\text{C}$, $V_{DD} = 12\text{V}$, $f_v = 60\text{Hz}$, $f_{DCLK} = 148.5\text{MHz}$, $I_F = 100\%$ duty

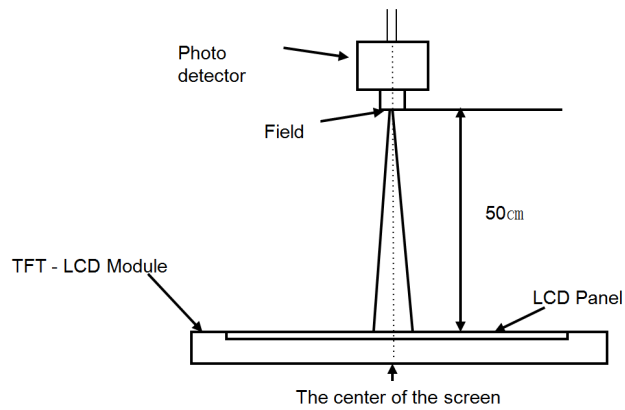
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		C/R	-	3000	4000	-	-	(3) SR-3
Response time	G-to-G (AVG)	T _g	-	-	8	15	msec	(5) RD-80S
Luminance of White (At the center of screen)		Y _L	-	300	400	-	cd/m ²	(6) SR-3
Color Chromaticity (CIE 1931)	Red	R _X	Normal ϕ = 0 θ = 0 Viewing Angle	TYP. -0.03	0.640	TYP +0.03	-	(7), (8) SR-3
		R _Y			0.333			
	Green	G _X			0.320			
		G _Y			0.605			
	Blue	B _X			0.150			
		B _Y			0.055			
	White	W _X			0.280			
		W _Y			0.290			
Color Gamut		-	-	66	70	-	%	(7) SR-3
Color temperature		-	-	-	10000	-	K	
Viewing Angle	Hor.	θ _L	CR ≥ 10	79	89	-	Degree	(8) EZ-Contrast
		θ _R		79	89	-		
	Ver.	θ _U		79	89	-		
		θ _D		79	89	-		
Brightness Uniformity (9 Point)		B _{uni}	-	-	-	25	%	(4) SR-3

Note (1) Test Equipment Setup

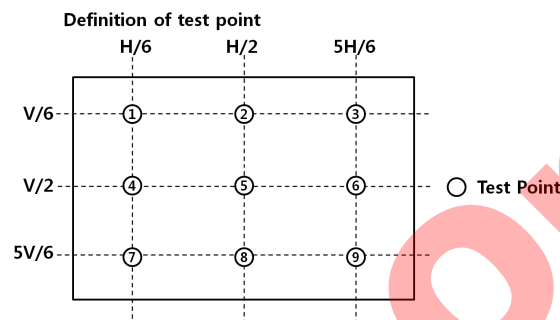
The measurement should be executed in a stable, windless and dark room between 40min and 60min after lighting the backlight at the given temperature for stabilization of the backlight. This should be measured in the center of screen.

LED : $I_F = 320\text{mA}$ / bar (each String 160mA),
Environment condition : $T_a = 25 \pm 2 \text{ }^{\circ}\text{C}$

Photo detector	Field
SR-3	1°



Note (2) Definition of test point



Note (3) Definition of Viewing angle : The range of Viewing angle($10 \leq C/R$).

: Ratio of max. gray (G_{max}) & min. gray (G_{min}) at the center point ⑤ of the panel.

$$C/R = \frac{G_{max}}{G_{min}}$$

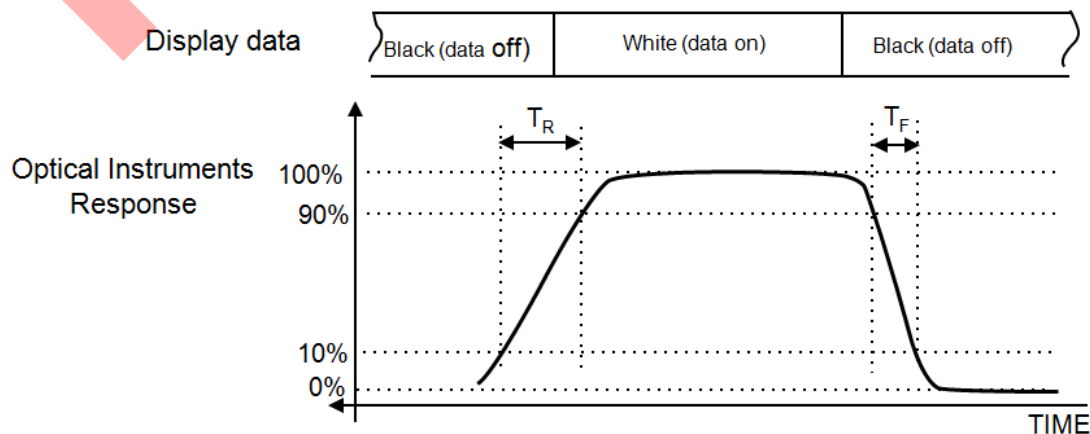
G_{max} : Luminance in all white pixels
 G_{min} : Luminance in all black pixels.

Note (4) Definition of brightness uniformity at 9 points (Test pattern : Full white)

$$B_{uni} = 100 * \frac{(B_{max} - B_{min})}{B_{max}}$$

B_{max} : Maximum brightness
 B_{min} : Minimum brightness

Note (5) Definition of Response time : Average response time of all Gray to Gray except T_R , T_F



※ G-to-G : Average response time between the whole gray scale to the whole gray scale.

Gray to Gray Response Time										
	Gray	End								
		0	31	63	95	127	159	191	223	255
Start	0		Tr(0-31)	Tr(0-63)	Tr(0-95)	Tr(0-127)	Tr(0-159)	Tr(0-191)	Tr(0-223)	Tr(0-255)
	31	Tf(31-0)		Tr(31-63)	Tr(31-95)	Tr(31-127)	Tr(31-159)	Tr(31-191)	Tr(31-223)	Tr(31-255)
	63	Tf(63-0)	Tf(63-31)		Tr(63-95)	Tr(63-127)	Tr(63-159)	Tr(63-191)	Tr(63-223)	Tr(63-255)
	95	Tf(95-0)	Tf(95-31)	Tf(95-63)		Tr(95-127)	Tr(95-159)	Tr(95-191)	Tr(95-223)	Tr(95-255)
	127	Tf(127-0)	Tf(127-31)	Tf(127-63)	Tf(127-95)		Tr(127-159)	Tr(127-191)	Tr(127-223)	Tr(127-255)
	159	Tf(159-0)	Tf(159-31)	Tf(159-63)	Tf(159-95)	Tf(159-127)		Tr(159-191)	Tr(159-223)	Tr(159-255)
	191	Tf(191-0)	Tf(191-31)	Tf(191-63)	Tf(191-95)	Tf(191-127)	Tf(191-159)		Tr(191-223)	Tr(191-255)
	223	Tf(223-0)	Tf(223-31)	Tf(223-63)	Tf(223-95)	Tf(223-127)	Tf(223-159)	Tf(223-191)		Tr(223-255)
	255	Tf(255-0)	Tf(255-31)	Tf(255-63)	Tf(255-95)	Tf(255-127)	Tf(255-159)	Tf(255-191)	Tf(255-223)	
Toff										

T*(X-Y) : Response time from level of gray at X to level of gray at Y

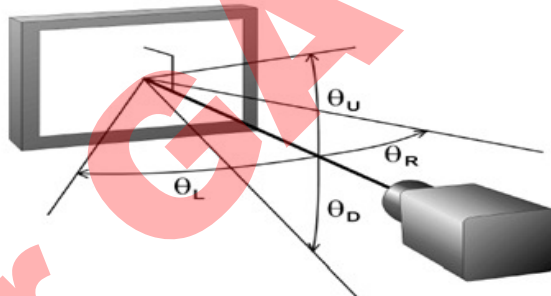
The definition of response time = $\sum [T^*(X-Y)] / 72$

Note (6) Definition of Luminance of White : Luminance of white at center point ⑤

Note (7) Definition of Color Chromaticity (CIE 1931)

Color coordinate of Red, Green, Blue & White at center point ⑤

Note (8) Definition of Viewing Angle : Viewing angle range (C/R ≥ 10)



4. ELECTRICAL CHARACTERISTICS

4.1 TFT LCD MODULE

The connector to transmit a display data and a timing signal should be connected.

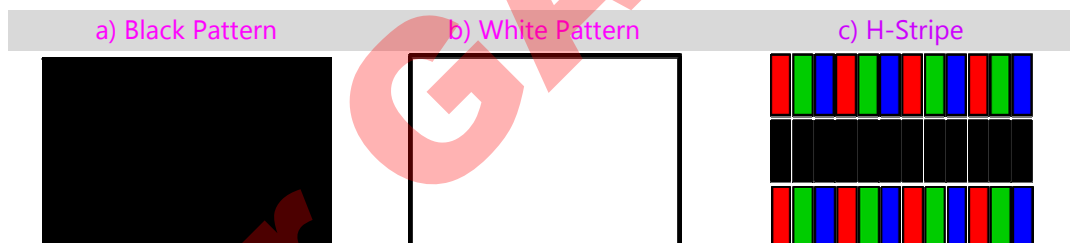
$T_a = 25 \pm 2^\circ\text{C}$

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply	V_{DD}	10.8	12.0	13.2	V	(1)
Current of Power Supply	(a) Black	-	670	762	mA	(2), (3)
	(b) White	-	788	897		
	(C) H-Stripe	-	1520	1765		
Vsync Frequency	f_V	48	60	62	Hz	-
Hsync Frequency	f_H	54	67.5	69.75	kHz	-
Main Frequency	F_{clk}	118.8	148.5	153.5	MHz	-
Rush Current	I_{RUSH}	-	-	7	A	(4)

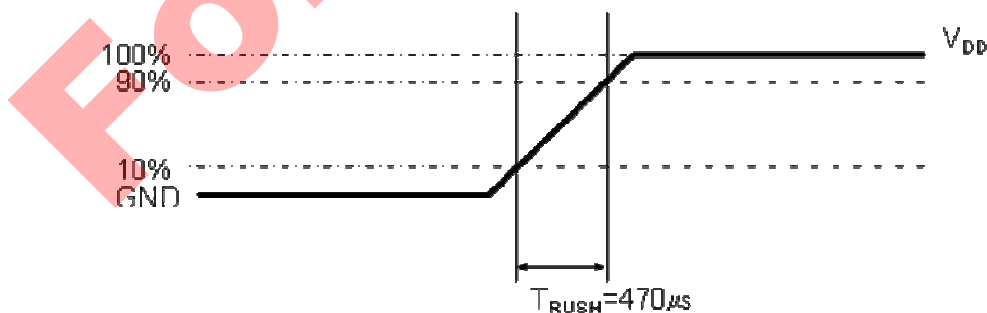
Note (1) The ripple voltage should be controlled under 10% of V_{DD} .

Note (2) $f_V=60\text{Hz}$, $f_{CLK} = 148.5\text{MHz}$, $V_{DD} = 12.0\text{V}$, DC Current.

Note (3) The pattern for checking the power dissipation (LCD module only).



Note (4) Conditions for measurement



The rush current, I_{RUSH} can be measured when T_{RUSH} is $470\mu\text{s}$.

4.2 BACK LIGHT UNIT

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Life Time	Hr	-	50,000	-	Hour	(1)

Note (1) It is Defined as the time to take until the brightness reduce to 50% of its original value
 [Operating Condition : Ta = 25±2℃ , IL = 160mA , For Single LED String Only]

4.3 CONVERTER INPUT CONDITION & SPECIFICATION

ITEM	SYMBOL	CONDITION	SPECIFICATION			UNIT	NOTE
			MIN	TYP	MAX		
Input Voltage	V _{IN}		22	24	26	V	
Inrush Current Note(2)(3)	I _{INRUSH,N}	V _{IN} = 24V, Dim=Max			13	A (max)	
Output Current(1)	I _{LED N}	V _{IN} = 24V V _{DIM} = Max	152	160	168	mAmean	@1String
Converter On/Off Control	ENA	Enable	2.4	-	5.25	V	
		Disable	-0.3	-	0.8		
Analog Dimming	V _{A_DIM}	V _{IN} = 24.0V	0	-	3.3	V	
	D _{A_DIM} (Duty)	V _{IN} = 24.0V V _{A_DIM} = 0V	29	32	35	mA	

Note (1) All data was approved after running 120 minutes.

(2) Inrush is measured within BLU on 10ms after leaving the BLU as it is at least 1hr
 or more at room temperature(25℃)

(3) Additional Appendix for Input current at room temperature (25℃)

ITEM	SYMBOL	CONDITION	SPECIFICATION			UNIT	NOTE
			MIN	TYP	MAX		
Input Current (Normal Mode)	I _{overshoot,N}	V _{IN} =24V, Dim=Max	-	10.3	10.6	Amean	Overshoot Current After Turn-on
	I _{saturation,N}		-	10.1	10.4	Amean	Saturation current after 1hr aging

5. INPUT TERMINAL PIN ASSIGNMENT

5.1 INPUT SIGNAL & POWER

Connector : FI-RE51S-HF-J(JAE)

Pin	Description		Pin	Description	
1	Vdd (12V)		26	LVDS Signal	RX2A_P
2	Vdd (12V)		27		RX2B_N
3	Vdd (12V)		28		RX2B_P
4	Vdd (12V)		29		RX2C_N
5	Vdd (12V)		30		RX2C_P
6	No connection		31	GND	
7	GND		32	LVDS Clock	RX2CLK_N
8	GND		33		RX2CLK_P
9	GND		34	GND	
10	LVDS Signal	RX1A_N	35	LVDS Signal	RX2D_N
11		RX1A_P	36		RX2D_P
12		RX1B_N	37	No connection	
13		RX1B_P	38	No connection	
14		RX1C_N	39	GND	
15		RX1C_P	40	No connection	NOTE1
16	Ground		41	No connection	
17	LVDS Clock	RX1CLK_N	42	No connection	
18		RX1CLK_P	43	No connection	
19	Ground		44	No connection	NOTE2
20	LVDS Signal	RX1D_N	45	LVDS_SEL	
21		RX1D_P	46	No connection	NOTE1
22	No connection		47	No connection	
23	No connection		48	No connection	
24	GND		49	No connection	
25	LVDS Signal	RX2A_N	50	No connection	
			51	No connection	

Note (1) No Connection : These pins are only used for SAMSUNG internal purpose.

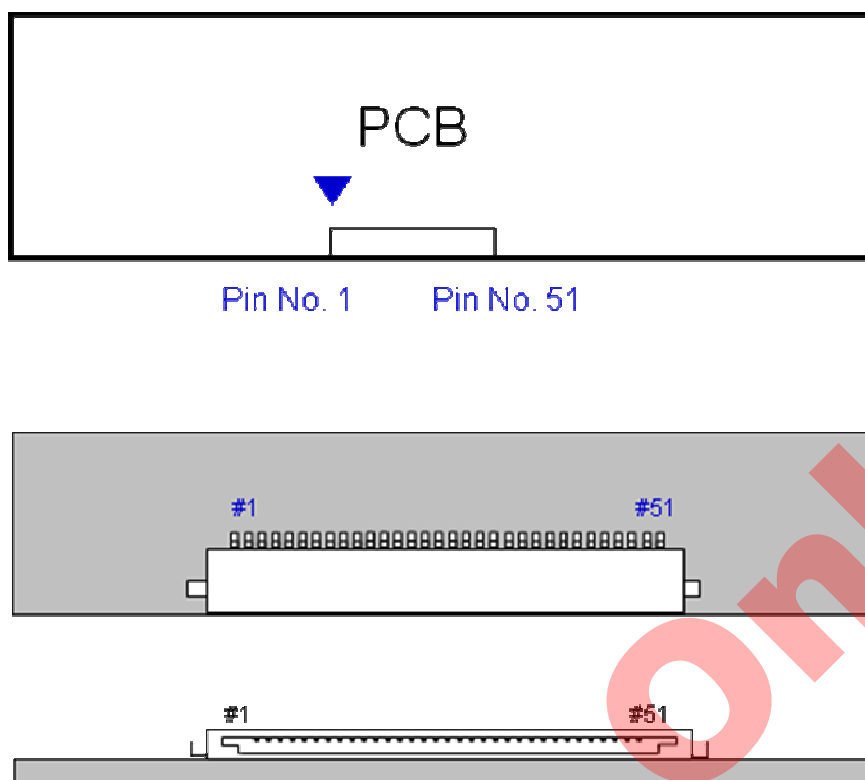
Note (2) LVDS Option : High(3.3V) → Normal NS LVDS format

Low(GND or N.C) → JEIDA LVDS format

Sequence : On = $V_{DD}(T1) \geq \text{LVDS Option} \geq \text{Interface Signal}(T2)$

Off = $\text{Interface Signal}(T3) \geq \text{LVDS Option} \geq V_{DD}$

Note (3) LVDS Connector



- All GND pins should be connected together and also be connected to the LCD's metal chassis.
- All power input pins should be connected together.
- All N.C pins should be separated from other signal or power.

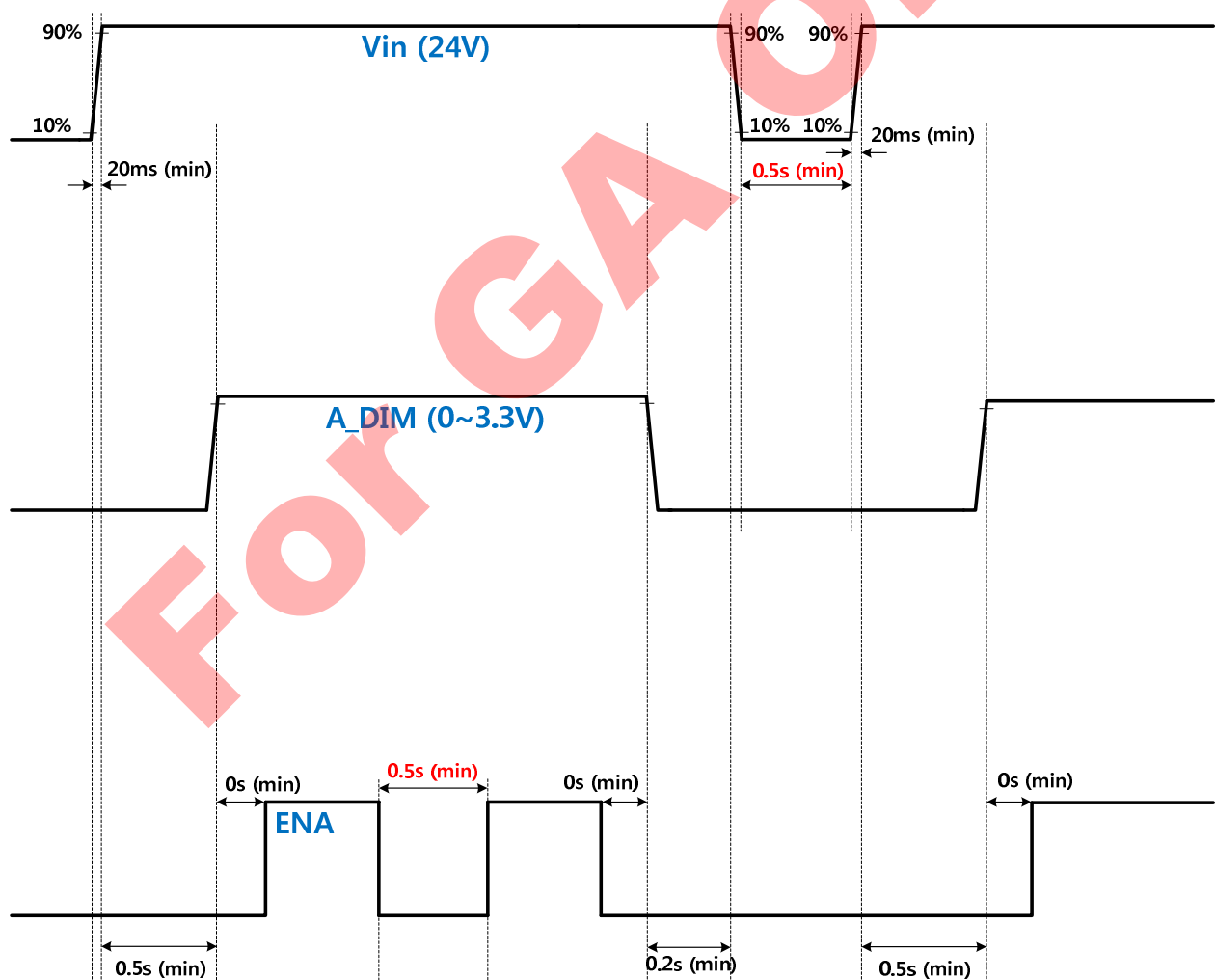
5.2 CONFIGURATION OF INPUT PIN OF CONVERTER

22022WR-014B1 (YEONHO)

Pin No.	SYMBOL	Pin Configuration(FUNCTION)
1, 2, 3, 4, 5	Vin	Power Supply DC 24V
6, 7, 8, 9, 10	GND	Ground
11	NC	No connection
12	ENA	ENA (Converter on/off Control signal)
13	A_DIM	Analog Dimming Control [0V: Min, 3.3V: MAX]
14	-	No Connection

Note) Pin 14 must be disconnected from signal

5.3 THE POWER SEQUENCE FOR INPUTTING TO THE CONVERTER



5.4 LVDS INTERFACE

- LVDS Receiver : Tcon(Merged)
- Data Format (JEIDA & Normal)

Default LVDS Option : JEIDA

LVDS OPTION(input : pin9) : IF THIS PIN : LOW (GND OR OPEN(NC)) → JEIDA LVDS FORMAT
OTHERWISE : HIGH (3.3V) → NORMAL NS LVDS FORMAT

	LVDS pin	JEIDA -DATA	VESA-DATA
TxOUT/RxIN0	TxIN/RxOUT0	R2	R0
	TxIN/RxOUT1	R3	R1
	TxIN/RxOUT2	R4	R2
	TxIN/RxOUT3	R5	R3
	TxIN/RxOUT4	R6	R4
	TxIN/RxOUT6	R7	R5
	TxIN/RxOUT7	G2	G0
TxOUT/RxIN1	TxIN/RxOUT8	G3	G1
	TxIN/RxOUT9	G4	G2
	TxIN/RxOUT12	G5	G3
	TxIN/RxOUT13	G6	G4
	TxIN/RxOUT14	G7	G5
	TxIN/RxOUT15	B2	B0
	TxIN/RxOUT18	B3	B1
TxOUT/RxIN2	TxIN/RxOUT19	B4	B2
	TxIN/RxOUT20	B5	B3
	TxIN/RxOUT21	B6	B4
	TxIN/RxOUT22	B7	B5
	TxIN/RxOUT24	HSYNC	HSYNC
	TxIN/RxOUT25	VSYNC	VSYNC
	TxIN/RxOUT26	DEN	DEN
TxOUT/RxIN3	TxIN/RxOUT27	R0	R6
	TxIN/RxOUT5	R1	R7
	TxIN/RxOUT10	G0	G6
	TxIN/RxOUT11	G1	G7
	TxIN/RxOUT16	B0	B6
	TxIN/RxOUT17	B1	B7
	TxIN/RxOUT23	RESERVED	RESERVED

5.5 INPUT SIGNALS, BASIC DISPLAY COLORS AND GRAY SCALE

COLOR	DISPLAY (8bit)	DATA SIGNAL																												GRAY SCALE LEVEL
		RED									GREEN									BLUE										
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7					
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-		
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	-			
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	-			
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-			
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-			
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	-			
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	-			
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-			
GRAY SCALE OF RED	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0			
	DARK ↑ ↓ LIGHT	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1			
		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	R3~ R252			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:					
		1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R253			
		0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R254			
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R255			
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0			
	DARK ↑ ↓ LIGHT	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G1			
		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G2			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	G3~ G252			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:					
		0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	G253			
		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	G254			
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G255				
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0			
	DARK ↑ ↓ LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	B1			
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	B2			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	B3~ B252			
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:					
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	B253			
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	B254			
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	B255			

Note) Definition of Gray

Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray(n = Gray Level)

Input Signal : 0 = Low Level Voltage, 1 = High Level Voltage

6. INTERFACE TIMING

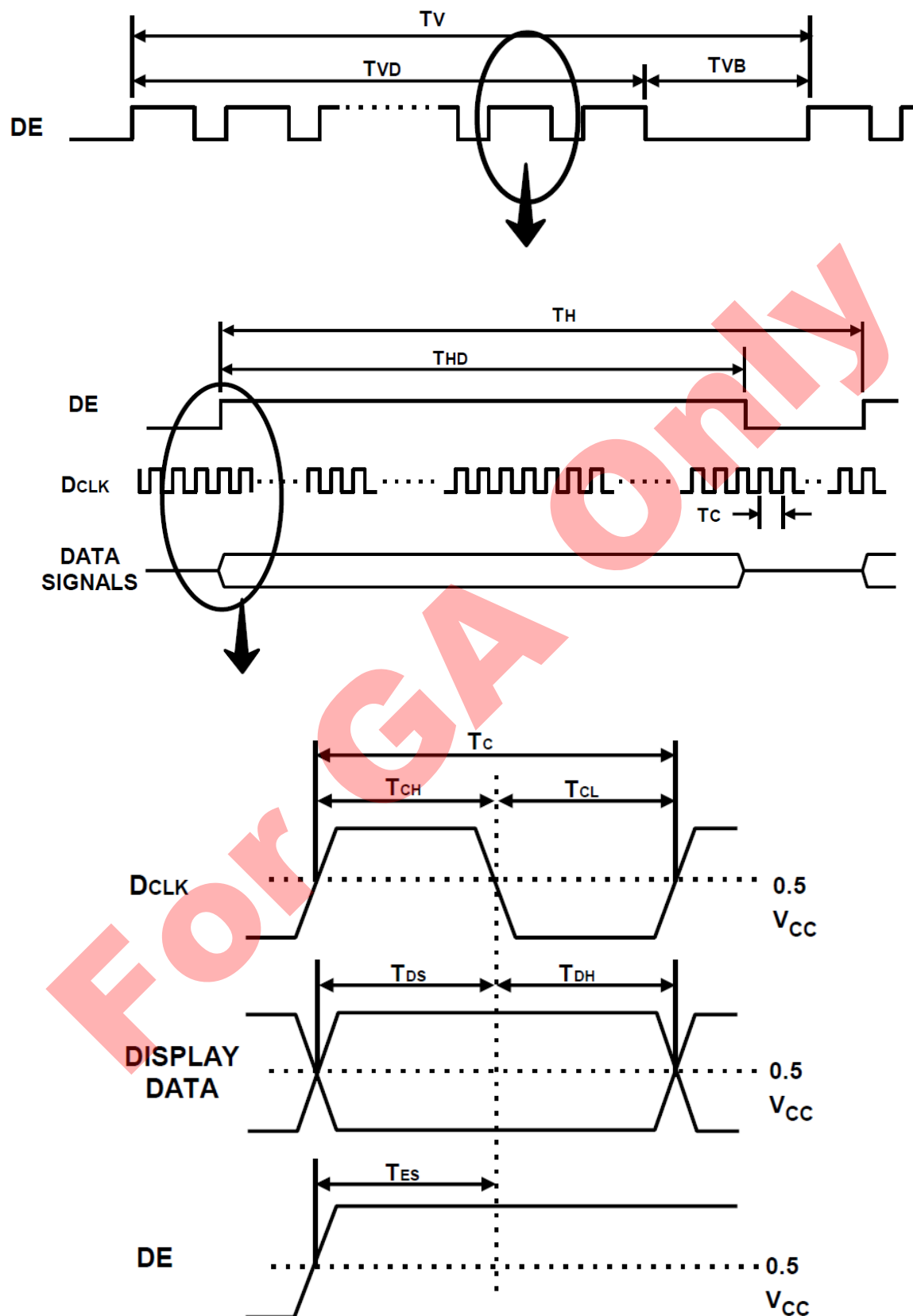
6.1 TIMING PARAMETERS (DE ONLY MODE)

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	Unit	NOTE
Clock	Frequency	$1/T_C$	118.8	148.5	153.5	MHz	-
Hsync		F_H	54	67.5	69.75	KHz	-
Vsync		F_V	48	60	62	Hz	-
Term for the vertical display	Active display period	T_{VD}	-	1080	-	Lines	-
	Total vertical	T_V	1100	1125	1158	Lines	-
Term for the horizontal display	Active display period	T_{HD}	-	1920	-	Clocks	-
	Total Horizontal	T_H	2090	2200	2350	clocks	-

Note) The signals of Hsync and Vsync must be inputted even though this T-con is operated at DE mode.

- (1) Test Point: TTL controls signal and CLK at LVDS Tx at the input terminal of system.
- (2) Internal VDD = 3.3V
- (3) The spread spectrum
 - The limit of spread spectrum's range of SET in which the LCD module is assembled should be within $\pm 1.5\%$
 - Frequency for modulation : Min 30KHz

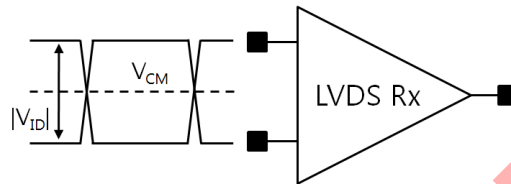
6.2 TIMING DIAGRAMS OF INTERFACE SIGNAL (DE ONLY MODE)



6.3 CHARACTERISTICS OF INPUT DATA OF LVDS

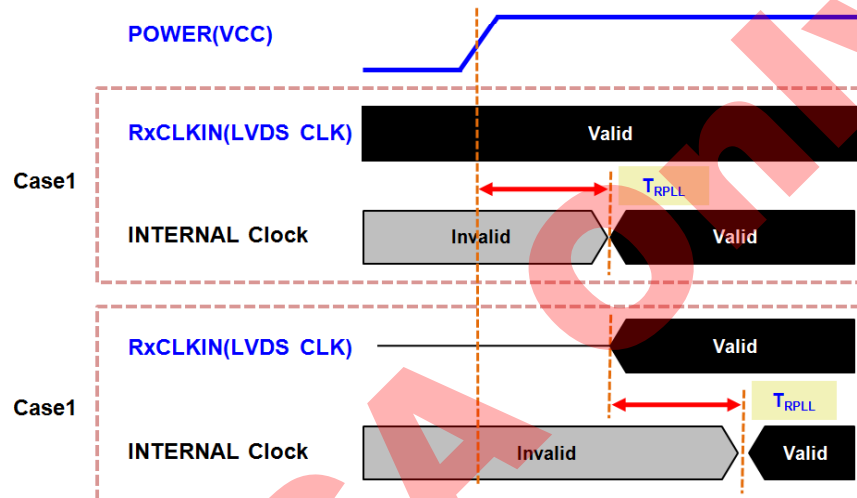
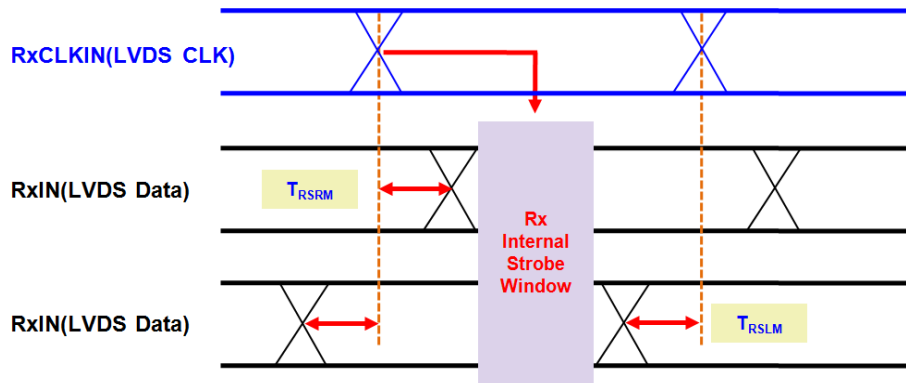
(1) Specification for DC

ITEM	SYMBOL	Min.	Typ.	Max.	UNIT
Supply voltage for IO	VDD33_LVDS	3.0	3.3	3.6	V
Supply voltage in the core	VDD12_LVDS	1.1	1.2	1.3	V
Color depth			8/10		Bit
Input voltage at the common mode	V_{CM}	0.3		1.8	V
Input voltage for differential	$ V_{ID} $	100	350	600	mV

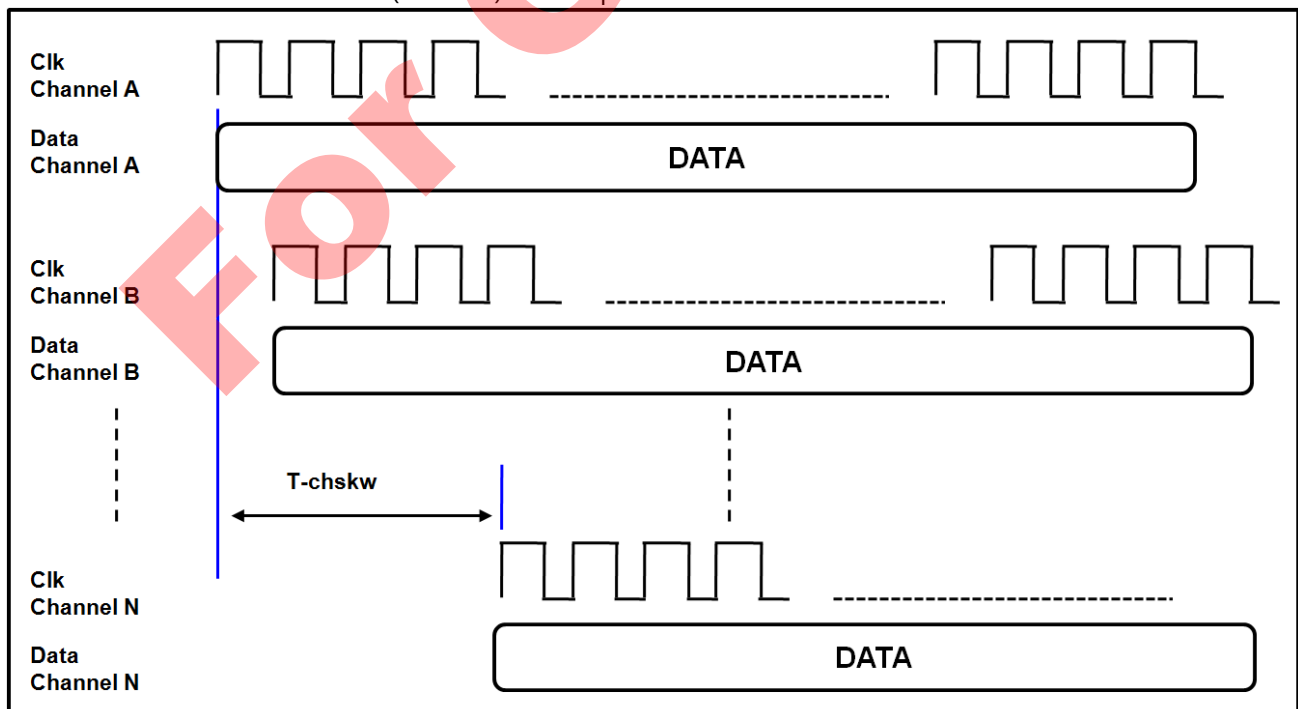


(2) Specification for AC

ITEM	SYMBOL	Min.	Typ.	Max.	UNIT
Frequency for input clock (=1/T)	FIN	25	-	90	MHz
Period of output clock	t_{RCP}	11.11	-	40	ns
Position of input data	FIN=85MHZ	-	-	+400	ps
	FIN=78MHZ	-	-	+450	
	FIN=75MHZ	-	-	+500	
Position of input data	FIN=85MHZ	-400	-	-	ps
	FIN=78MHZ	-450	-	-	
	FIN=75MHZ	-500	-	-	
Lock time	t_{RPLL}	-	-	100	usec
Duty ratio of Rx's clock for output	T_{duty}	45	50	55	%



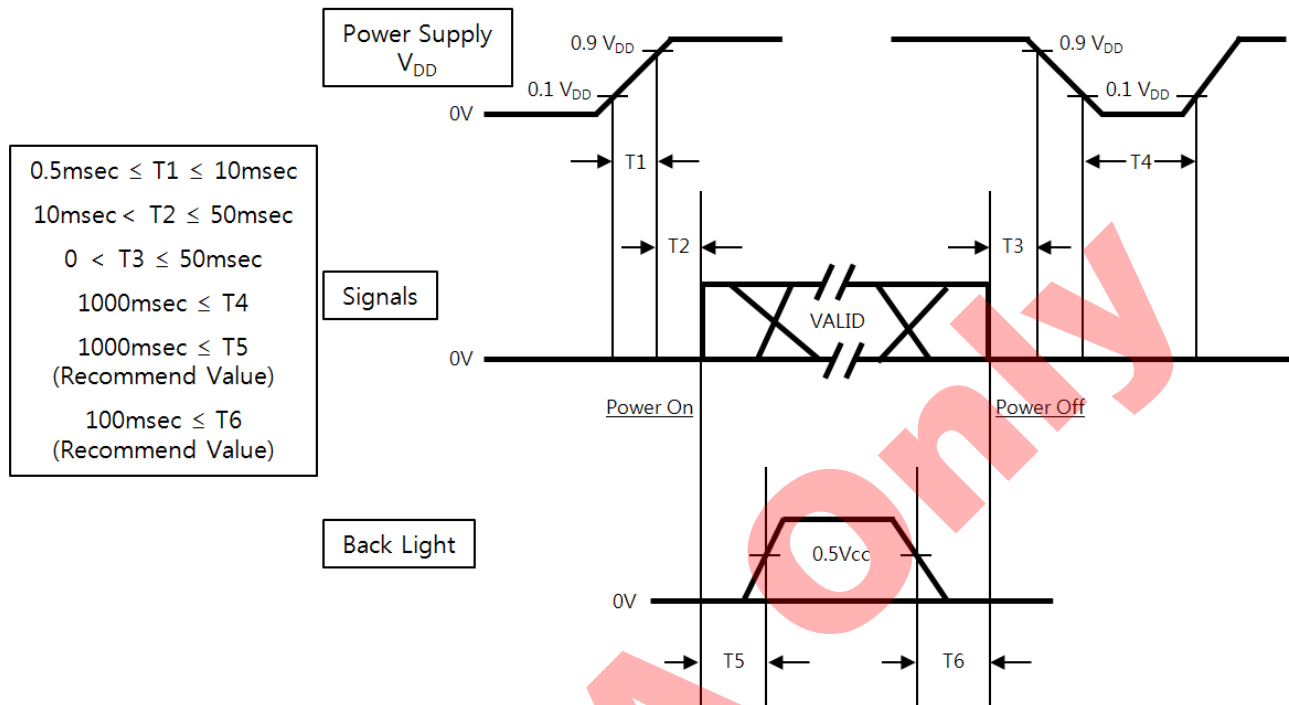
* LVDS Channel to Channel Skew(T_{chskw}) in Multiple LVDS Channels



Note : DE should be synchronized with DE per each LVDS Channel and $T_{chskw} < 16 \times \text{LVDS Clock Period}$

6.4 THE SEQUENCE OF POWER ON AND OFF

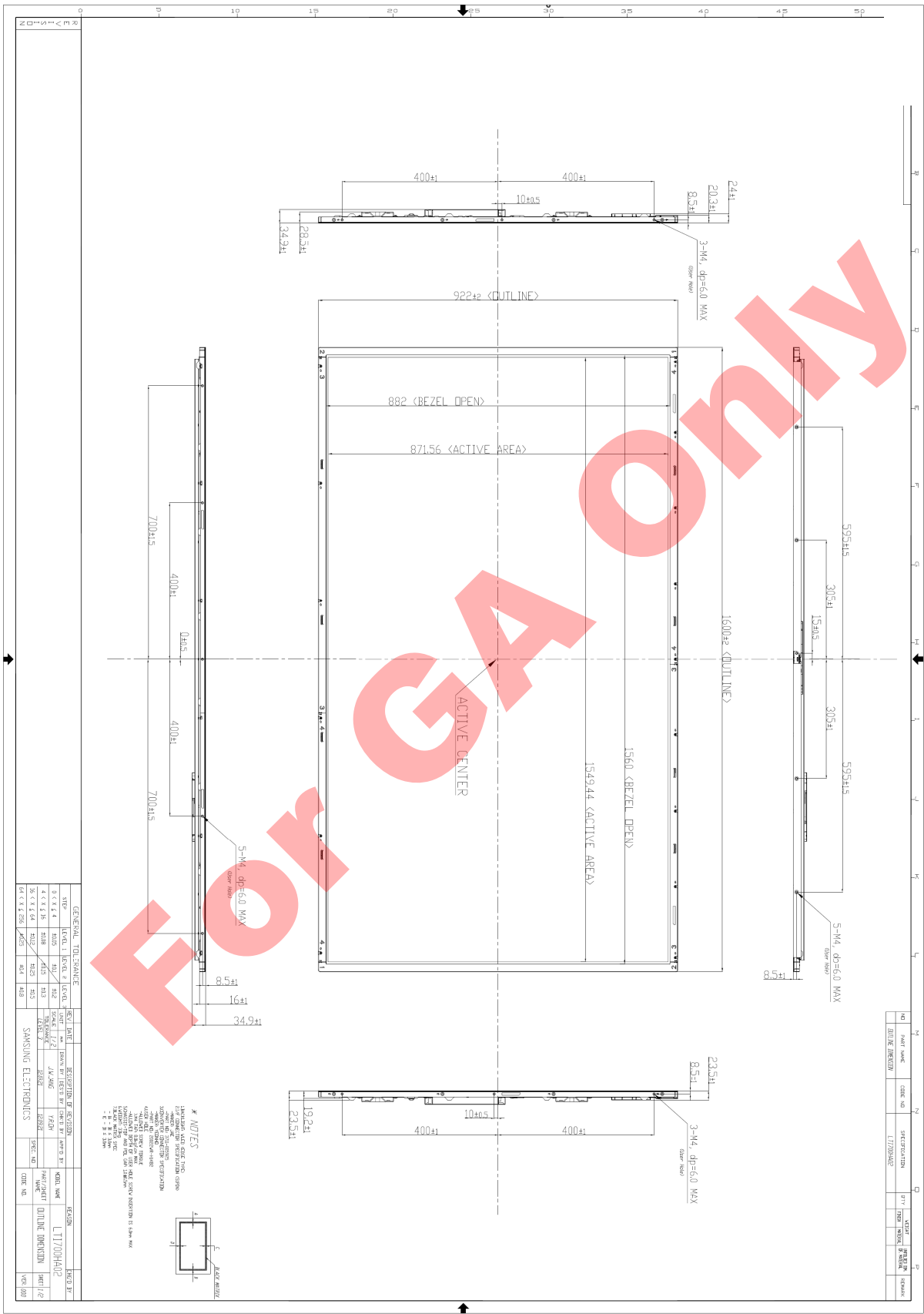
To prevent the product from being latched up or the DC in the LCD module from starting an operation, the order to turn the power on and off should be changed to the order as shown in the diagram below.



Timing	Remarks
T_1	The time, during which the level of V_{DD} is rising from 10% to 90%.
T_2	The changing time, during which the V_{DD} starts rising beyond 90% until the valid data of signal started coming in.
T_3	The changing time, during which the valid data of signal starts leaving out until the V_{DD} starts falling below 90%.
T_4	The changing time, during which the V_{DD} starts falling below 10% to restart the Windows.
T_5	The changing time, during which the signal of BLU starts rising beyond 50%.
T_6	The changing time, during which the signal of BLU starts falling below 50%.

- The inputted V_{DD} 's value for supply voltage, BLU, and signal to the external system of the module shall be computed with referring to the former mentioned value.
- The method to apply the voltage to the lamp within the range, which the LCD operates. When the back-light is turned on before the LCD is operated or the power of LCD is turned off before the back-light is turned off, the abnormal display on the screen may be shown momentarily.
- Please keep the level of input signal low or keep the level of impedance high when the value of V_{DD} is below 10%.
- The value shall be measured after the module has been fully discharged between the period, which the power is turned on and the period, which the power is turned off like the T_4 timing. The backlight may be flashed if the interface signal remains floated when the above-mentioned signal becomes invalid.

7. OUTLINE DIMENSION
7.1 FRONT



GENERAL DIMENSIONS

ITEM	DESCRIPTION	UNIT	VALUE
1	PCB LAYER	mm	1.6
2	PCB THICKNESS	mm	1.6
3	PCB MATERIAL		FR-4
4	PCB FINISH		ENIG
5	PCB TOLERANCE	mm	±0.1
6	PCB DRILL TOLERANCE	mm	±0.05
7	PCB MOUNTING TOLERANCE	mm	±0.1
8	PCB PLATING TOLERANCE	mm	±0.05
9	PCB SOLDER TOLERANCE	mm	±0.1
10	PCB CLEANING TOLERANCE	mm	±0.1
11	PCB STORAGE TOLERANCE	mm	±0.1
12	PCB SHIPPING TOLERANCE	mm	±0.1
13	PCB INSPECTION TOLERANCE	mm	±0.1
14	PCB REWORK TOLERANCE	mm	±0.1
15	PCB DISPOSAL TOLERANCE	mm	±0.1

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. DIMENSIONS IN PARENTHESES ARE FOR INFORMATION ONLY.
3. DIMENSIONS IN SQUARE BRACKETS ARE FOR INFORMATION ONLY.
4. DIMENSIONS IN BRACKETS ARE FOR INFORMATION ONLY.
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13. DIMENSIONS IN BRACKETS ARE FOR INFORMATION ONLY.
14. DIMENSIONS IN BRACKETS ARE FOR INFORMATION ONLY.
15. DIMENSIONS IN BRACKETS ARE FOR INFORMATION ONLY.

8. RELIABILITY TEST

Item	Test condition	Quantity
HTOL	50°C, 500hr determination	8 EA
LTOL	0°C, 500hr determination	4 EA
HTS	70°C, 500hr determination	4 EA
LTS	-25°C, 500hr determination	4 EA
THB	50°C/80%RH, 500hr determination	4 EA
WHTS	60°C/75%RH, 500hr determination	4 EA
T/S	-20~60°C, Dwell time : 30min, 100cycle	4 EA
TSS	-20~65°C, 220cycle	4 EA
Image Sticking	50°C, Mosaic pattern(9X10)	4 EA
Contact ESD	±10kV, 105pF/330Ohm, 210Point, 1 time/Point	3 EA
Air ESD	±20kV, 150pF/100Ohm, 210Point 1time/Point	3 EA
Input Con. ESD	±15kV, 150pF/330Ohm, Input Con. Pin. 3times/Pin	3 EA
Dust	JIS 8types(6.6~8.6um), Carbon black(20nm) 4g, 5sec spray, 5min sedimentation /10hr Power 10min on, 10min off	2 EA
Pallet Vibration Pallet Drop	Pallet vibration : 1.05Grms, 5~200Hz, 2hr/stack side Pallet Drop : 20cm bottom side 2 angles, 1side(Bottom)	1 Pallet
Altitude	-40~50°C, 0m(0ft)~13,700m(45,000ft), 72.5Hr	4 EA
Twist	10°, 0.7sec/times, 250times	4 EA

[Result Evaluation Criteria]

Under the display quality test conditions with normal operation state, these should be no change which may affect practical display functions.

* HTOL/LTOL : High/Low Temperature Operating Life

** THB : Temperature Humidity Bias

*** HTS/LTS : High/Low Temperature Storage

**** WHTS : Wet High Temperature Storage

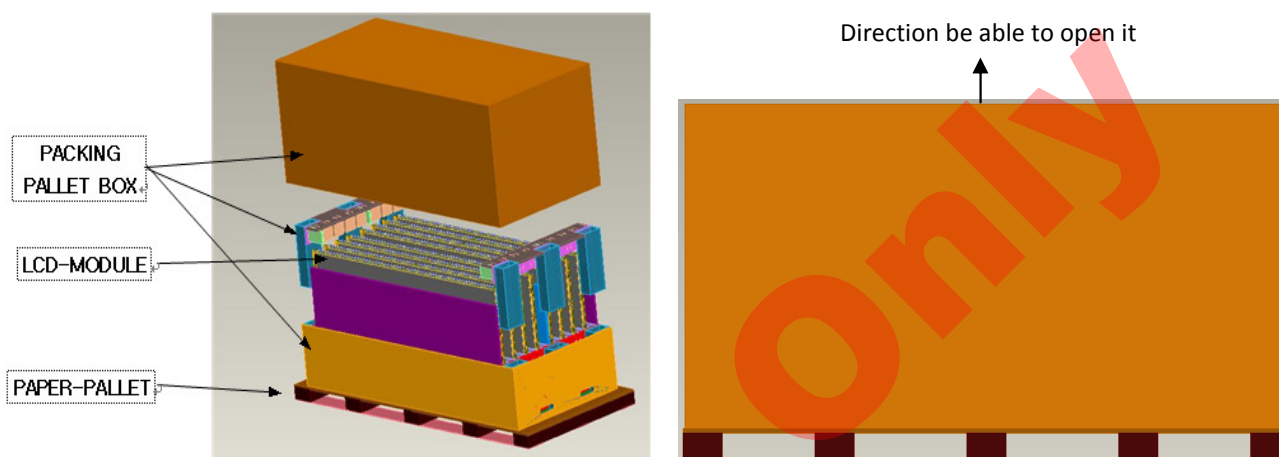
9. PACKING

9.1 CARTON (INTERNAL PACKAGE)

(1) Packing Form

Corrugated fiberboard box and corrugated cardboard as shock absorber.

(2) Packing Method



Note(1) Total Weight : Approximately 291.2kg

Note(2) Acceptance number of piling : 1Pallet

Note(3) Carton size : 2025mm(H)x1050mm(V)x1111mm(Height)

(3) Packing Material

No	Part name	Quantity
1	Packing-Pallet BOX	1EA
2	Bag-shielding	8EA
3	Protector-Panel	8EA
4	Paper-Pallet	1EA

10. MARKINGS & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

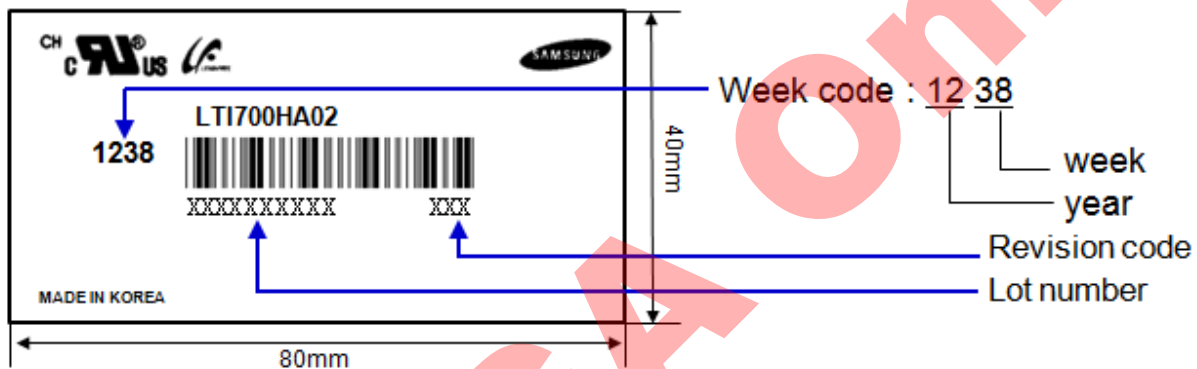
(1) Parts number : LTI700HA02

(2) Revision code : Three letters

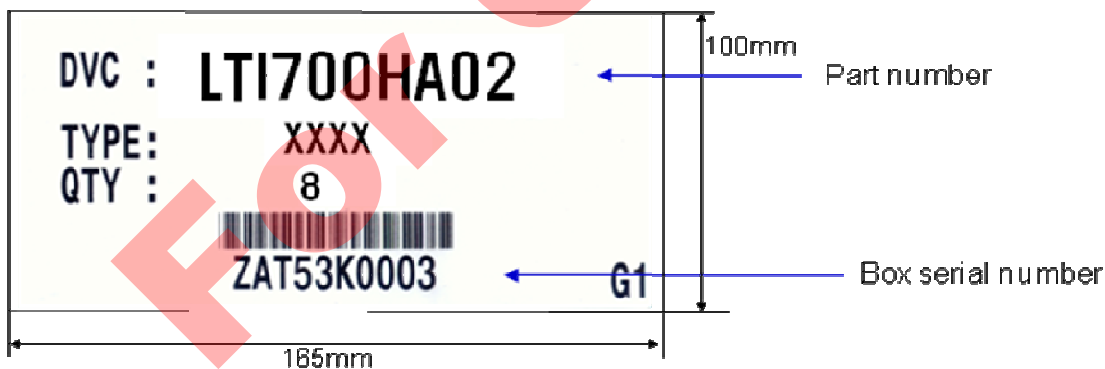
(3) Lot number : X X X X XXX XX X

Cell Position No. (In the Glass)
Glass No. (In the one Lot)
Lot No. (Glass)
Month
Year (Note1)
Product code
Line

(4) Nameplate Indication



(5) Packing small box attach



11. GENERAL PRECAUTIONS

11.1 HANDLING

- (a) When the module is assembled, It should be attached to the system firmly using every mounting holes. Be careful not to twist and bend the modules.
- (b) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and CCFT back-light.
- (c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.
- (d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.
- (e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (f) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
- (g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.
- (h) Protect the module from static. it may cause damage to the C-MOS Gate Array IC.
- (i) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (j) Do not disassemble the module.
- (k) Do not pull or fold the Lamp wire.
- (l) Do not touch any component which is located on the back side.
- (m) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (n) Pins of I/F connector shall not be touched directly with bare hands.

11.2 STORAGE

We highly recommend to comply with the criteria in the table below.

ITEM	Unit	Min.	Max.
Storage Temperature	(°C)	5	40
Storage Humidity	(%rH)	35	75
Storage life	12 months		
Storage Condition	<ul style="list-style-type: none"> - The storage room shall be equipped with a good ventilation facility, which has a temperature controlling system. - Products shall be placed on the pallet, which is away from the wall not on the floor. - Prevent products from being exposed to the direct sunlight, moisture, and water; Be cautious not to pile the products up. - Avoid storing products in the environment where other hazardous material is placed. - If products are delivered or kept in the storage facility more than 3 months, we recommend you to leave products under the condition including a 20°C temperature and a humidity of 50% for 24 hours. 		

11.3 OPERATION

- Do not connect or disconnect the cable to/ from the module at the "Power On" condition.
- The power shall be always turned on/off by the item 6.5. "Power on/off sequence"
- The module has a circuit with a high frequency. The system manufacturers shall suppress the electromagnetic interference sufficiently. The methods to ground and shield are important to minimize the interference.
- Design the length of cable to connect between the connector for back-light and the inverter as short as possible and the shorter cable shall be connected directly.
The longer cable between that of back-light and that of inverter(converter) may cause the luminance of lamp(LED) to lower and need a higher startup voltage(Vs).

11.4 OPERATION CONDITION GUIDE

- The LCD product should be operated under normal conditions.
Normal condition is defined as below;
 - Temperature : 20±15°C
 - Humidity : 55±20%
 - Display pattern : continually changing pattern (Not stationary)
- If the product will be used in extreme conditions such as high temperature, humidity, display patterns or operation time etc., It is strongly recommended to contact SDC for Application engineering advice.
Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at Airports, Transit Stations, Banks, Stock market, and Controlling systems.

11.5 OTHERS

- (a) Ultra-violet ray filter is necessary for outdoor operation.
- (b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.
- (c) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- (d) If the Module keeps displaying the same pattern for a long period of time, the image may be "sticked" to the screen. To avoid image sticking, it is recommended to use a screen saver.
- (e) This Module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.
- (f) Please contact SDC in advance when you display the same pattern for a long time.